

AIR FORCE PLANT PJKS, SYSTEMS INTEGRATION  
LABORATORY, COMPONENTS TEST LABORATORY  
(Air Force Plant PJKS, Systems Integration  
Laboratory, Building T-27)  
Waterton Canyon Road and Colorado Highway 121  
Lakewood Vicinity  
Jefferson County  
Colorado

HAER No. CO-88-A

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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Rocky Mountain System Support Office  
National Park Service  
P.O. Box 25287  
Denver, Colorado 80225-0287

**HISTORIC AMERICAN ENGINEERING RECORD**

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**AIR FORCE PLANT PJKS, SYSTEMS INTEGRATION LABORATORY,**  
**COMPONENTS TEST LABORATORY**

(Air Force Plant PJKS, Systems Integration Laboratory, Building T-27)

HAER No. CO-88-A

**Location:** Waterton Canyon Road and Colorado Highway 121, Lakewood Vicinity, Jefferson County, Colorado

**Date of Construction:** 1960-61

**Fabricator:** Kaiser Steel Corporation, Fabricating Division, Montebello, California

**Present Owner:** U.S. Air Force

**Present Use:** Missile propellant system component testing, evaluation, handling, and storage for compatibility determinations

**Significance:** The Components Test Laboratory played a significant role in the development of the Titan II ICBM, which not only served as the largest and most destructive weapon in the U.S. nuclear arsenal during the Cold War (1962-87) but also functioned as a launch vehicle for the Gemini space program in 1965. The laboratory served as a facility for testing, handling, and storage of Titan II's hydrazine- and nitrogen tetroxide-based propellant system components for compatibility determinations. Testing and evaluation of underground storage systems, temperature conditioning, and pressurized transfer of Titan II propellants in this facility were critical to missile research and development and contributed to the success of the exceptionally significant Titan II program.

**Historian:** Harlan D. Unrau, National Park Service, Denver Service Center, 1999.

**Description:** Constructed in 1960-61 as part of the Systems Integration Laboratory complex, the Components Test Laboratory (T-27) is located on a bench approximately 500' east of the Cold Flow Laboratory (T-6) and just downhill to the south-southwest of the Systems Integration Laboratory (T-28) complex at Lockheed Martin Astronautics. This building is functionally linked to additional buildings in the laboratory complex.

The single-story reinforced concrete structure has an irregular cruciform shape, contains 6,100 square feet of floor space, and rests on a reinforced concrete foundation. The structure contains three test cells. The oxidizer cell -- designated

Test Cell 8 -- is located at the west end of the structure; the fuel cell -- designated Test Cell 9 -- is at the east end; and the environmental cell -- designated Test Cell

10 -- is at the south end. Each of the test cells are approximately 25' x 30'. A selector valve was constructed in the environmental test cell to conduct oxidizer or fuel spills to their respective waste flumes. The test cells each have exterior remotely-controlled steel roll-up doors (20'-0" x 10'-0").

A central control room (approximately 26' x 25'), located between the test cells, serves as the control point for all testing operations that are conducted in the cells. The control room has two observation windows, referred to as blast proof observation ports (each having approximately 2 square feet of viewing area), in each of its walls that are common with those of the test cells. A small toilet room, with lockers, is located at the north side of the control room.

An equipment room (approximately 30' x 31'), designed to house test and area support equipment such as heating and ventilating equipment and generators, is located adjacent to the control room at the north end of the building. A separate storage room (10' 2" x 10' 2") was partitioned off in the northeast corner of the equipment room to house safety equipment. A deluge valve room, or valve station, is located just outside the southeast corner of the equipment room. This room, which houses the fire deluge (fire control) valves that are remotely controlled from the control room, is heated to prevent freezing of valves during cold weather.

At the west and east ends of the structure, adjacent to the oxidizer and fuel test cells, respectively, are aluminum-sided storage pits or vaults 15'-0" below grade that are used for storage of oxidizer and fuel components, respectfully. The vaults contain vessels, tanks, conditioning equipment, pressurization systems, piping, and venting. The storage vaults have sloping reinforced concrete floors that permit drainage, and their walls terminate above the curbing to allow for air circulation.

An exterior three-sided steel-strutted aluminum lean-to structure (14'-0" x 20'-0") housing the laboratory's air conditioning unit is located on the west side of the equipment room's exterior.

The structure has 12-inch thick reinforced concrete or concrete block walls designed to withstand impacts from propellant explosions and resulting debris. The test cells have 6-inch concrete floors, while the floors in the remainder of the structure are of 5-inch concrete. The floors of the test cells are sloped to permit cell drainage. When the building was constructed, asphalt tile covered the control room floor.

The structure's ceilings are exposed to the reinforced concrete slab roof. The test cells have roofs of gable construction. Tar and gravel cover the equipment and control rooms, while aluminum insulated sandwich panels cover the test cells and storage pits.

Each test cell and storage area is equipped with flume gates to control the flow of oxidizer or fuel spillages and to conduct the spilled fluids to their respective disposal basins, or, in the case of water, to grade.

The area surrounding the structure is paved with Portland cement concrete capable of supporting 18,000-pound axle loads.

Various facilities relating to the operation of the Component Test Laboratory are located in the vicinity of the structure. Oxidizer and fuel waste tanks are located downslope from the laboratory -- the oxidizer waste tank to the southwest and the fuel waste tank to the southeast. Nitrogen heating facilities, associated with the building's original construction, are located upslope to the north of the laboratory. A valve pit is located just west-northwest of the building along the north side of the access road leading to the structure. A metal-tubed flair above the pit allows fumes to escape and dissipate into the air.

The building has undergone little structural modification since its construction, and onsite examination found no evidence of significant structural alterations. However, use of this structure to support testing of later launch vehicle systems, such as the Titan III and Titan IV, has resulted in upgrades and modifications to its technological systems and instrumentation. During 1997-99, the structure's ventilation systems, vaults, and test cells were significantly modified and upgraded and its underground drain lines were replaced to accommodate component testing requirements for the Atlas V, a new missile system using a liquid oxygen propellant system similar to that of the Titan I.

**History:** The Components Test Laboratory was constructed on Air Force property adjacent to the Glenn L. Martin Company's Denver Division plant during 1960-61. In May 1960, the Martin Company contracted with the Kaiser Steel Corporation, Fabricating Division, of Montebello, California, to prepare the design specifications for and construct the laboratory facility as part of the Systems Integration Laboratory complex for Titan II propellant system testing. The specifications and design drawings, based on design criteria developed by Martin Company Cold Flow Laboratory personnel, were prepared by ARCAL, Engineers-Constructors of Pasadena, California, under a subcontract from Kaiser Steel. Initial construction operations began in late June or early July 1960. Construction was completed by early March 1961.

The facilities of the Components Test Laboratory were first used on June 7, 1961, when the Martin Company started its captive test program for the Titan II with the firing of a second-stage engine on nearby Test Stand D-1. Later on December 28, 1961, a Titan II missile underwent a complete captive-fired simulated flight in a static sequence test at the test facility. The facilities of the Components Test Laboratory were utilized for testing the Titan II's propellant system components during 1961-64. The testing procedures involved the flowing of fuel and oxidizer through the numerous components of the Titan II, including valves, tubes, transfer lines, metering devices, pressure gauges, and pumps. The components were tested for form, fit, and function as well as reliability to minimize failure of the expensive Titan II missiles. Subsequently, the facility played a significant role in propellant system component evaluations for the Titan III and Titan IV launch vehicles.

**Sources:** Sources include architectural drawings, blueprints, and site plans in the Engineering Propulsion Laboratory and Plant Engineering and Construction Department at Lockheed Martin Astronautics. The corporation's Photographic Laboratory, Reproduction Services Department maintains an extensive collection of black and white and color photographs depicting construction, equipment, and testing activities at the laboratory. Typescript copies of the contract and specifications for the structure may be found in the Archives of the corporation's Engineering Propulsion Laboratory. Printed and/or published materials relating to the design and utilization of the structure include: "Criteria For the Design of XSM 68B Cold Flow Systems Test Laboratory and Components Test Laboratory, The Martin Company, Denver Division, Denver, Colorado, April 15, 1960," Compiled by Cold Flow Laboratory Facilities Group (copy in Archives, Engineering Propulsion Laboratory, Lockheed Martin Astronautics); "Part II Valuations for Appraisal of Government-owned Test Area, Sections 20, 21, 28, 29, T6S, R69W, 6th P.M., Jefferson County, Colorado for Martin Marietta Corporation by Blaine B. Chase, MAI, SRA, and Wilson W. Wampler, July 1, 1971 (copy in Plant Engineering and Construction Department, Lockheed Martin Astronautics); and U.S. Department of the Air Force, Air Force Materiel Command, Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio and U.S. Department of the Army, Fort Worth District, Corps of Engineers, Fort Worth, Texas, Historic Building Inventory and Evaluation, Air Force Plant PJKS, Jefferson County, Colorado, prepared by EARTH TECH, Colton, California, and William Manley Consulting, San Diego, California, February 1997. Completion of the structure and its first utilization as part of the Titan II testing program are chronicled in "Main Area Profiles Change With Plant, Titan II Facilities," Martin Mercury 18 (10 March 1961): 2A, 2C; "First Titan II Propulsion System Test Firing at M-D," Martin Mercury 18 (16 June 1961): 2C; and "Titan II Passes Its First Captive Firing," M News 19 (12 January 1962): 1, 3.